LIST OF COURSES TO BE OFFERED TO M.V.SC STUDENTS
(ANIMAL NUTRITION)

SEMMESTER 1

MAJOR DISCIPLINE (Animal Nutrition)

AN-611(3+0) Energy and Protein
AN 612(2+1) Non conventional Feed stuffs and toxic constitutents/ antimetabolites in animal feedstuffs
AN 613(1+1) Feed Technology
AN 614 (2+2) Feeds and Forages for livestock
AN 615(2+1) Ruminant Nutrition

SUPPORTING COURSE

AB 601(3+1) Basic Biochemistry
Total credits : 19

Total credits : Major : 15 Supporting
(Animal Biochemistry): 4
Total : 19

SEMMESTER 11

MAJOR COURSES

AN 621(3+1) Animal Nutrition-Minerals,vitamins and Feed additives
AN 622 (1+1) Non- Ruminant Nutrition
AN 623 (2+1) Nutrition of companion/laboratory, wild and zoo animals
AN 624 (1+3) Research Techniques in Animal Nutrition
AN-625 (3+1) Principles and Practices in Animal Nutrition
ANN 629 (1+0) Masters Seminar

MINOR DISCIPLINE (Animal Physiology)

AP 608 (2+1) Chemical Bioregulation in Physiological Processes
AP 609 (2+1) Environmental Physiology

SUPPORTING COURSES

ES 629 (3+1) Design of experiment

Total credits (Semester 11): Major 13
Minor 6
Supporting 4
Seminar: 1
Total: 24

Overall credits during sem 1 and 11 Major : 15+13=28 Required: Major:24
Minor :6 Minor : 6
Supporting: 8 Supporting: 3
Seminar :1 Seminar: 1
Thesis:20 Thesis: 20
Total : 63 Total : 60

1
LIST OF COURSES TO BE OFFERED TO Ph.D STUDENTS
(ANIMAL NUTRITION)

SEMMESTER 1

MAJOR DISCIPLINE

AN 711 (2+0) Modern concepts of feeding monogastric animals
AN 712 (2+0) Nutrition and rumen fermentation

AN 713 (1+0) Advances in micronutrients
AN 714 (1+2) Advanced techniques in nutrition and research AN 719 (1+0) Doctoral seminar

MINOR DISCIPLINE
AP 706 (3+0) Advances in Biosynthesis and secretion of milk

SUPPORTING COURSE
BT 602 (3+0) Fundamentals of cell and molecular biology.

Total Credits (Semester 1): Major: 8
Minor: 3
Supporting: 3
Seminar: 1
Total: 15

SEMMESTER 11

MAJOR COURSES

AN 721 (3+0) Modern concepts of feeding ruminants and Forage utilization
AN 722 (1+0) Advances in Feed technology
AN 723 (1+0) Clinical Nutrition
AN 724 (2+0) Nutrient and Drug interaction
AN 725 (2+0) New feed resources and toxicants in animal feeding
AN 729 (1+0) Doctoral seminar

MINOR COURSES
AP 705 (3+0) Advances in Reproductive Physiology

SUPPORTING COURSE
CS 621 (2+1) Computer software package for statistical analysis

Total Credits (Semester 2) : Major:9
Minor: 3 Supporting:3 Seminar :1
Total:16

Overall credits during Sem 1 and 11 Major : 17 Required Major : 15
Minor:6 Minor: 6
Supporting: 6 Supporting :3
Seminar:2 Seminar: 2
Thesis :45 Thesis: 45
Total:76 Total: 75
ANIMAL NUTRITION (M.V.Sc Revised)
Course Contents

AN 611 ANIMAL NUTRITION - ENERGY AND PROTEIN (2+1)

Objective
Familiarization with fundamental concepts of energy and proteins, metabolism of carbohydrate, fat and protein and their efficiency of utilization. Requirement of carbohydrates, fat and proteins for various physiological functions.

Theory

UNIT I
The classification and chemistry of carbohydrates, fats, proteins and their sources. Chemistry of cell wall constituents. Recent methods such as CNCP for feed analysis. Fundamental concepts of Digestion and metabolism of Carbohydrate Fat and Protein in different species of animals. Metabolism of Volatile fatty acids. Gluconeogenesis, Recent advances in glucogenic precursors on acetate utilization. NPN metabolism, urea fermentation potential and metabolizable protein. Amino acids imbalance, antagonism and toxicity.

UNIT II

UNIT III
Rumen degradable Protein (RDP), and rumen undegradable protein (UDN) and Kinetics. Energetics of protein synthesis and turn over. Quantification of microbial protein synthesis. Protein quality determination in monogastrics and ruminants.

UNIT IV

Suggested Readings
AN 612 RUMINANT NUTRITION (2+1)

Objective
Requirement of nutrients for different physiological functions in various ruminant species. Latest concepts of feeding the nutrients for maximising production.

Theory

UNIT I
Nutrients and their metabolism with special reference to milk, meat and wool production.

UNIT II
Feeding standards, their history, comparative appraisal and limitations. Classification of feedstuffs. Nutrient requirements for calves, heifers, dry, pregnant and lactating cows, buffaloes, sheep and goat.

UNIT III
Introduction to rumen microflora and fauna. Development of rumen. Defaunation and animal productivity rumen fungi, NPN compounds, microbial Protein synthesis. Role of milk replacers and calf starters.

UNIT IV
Feed formulation of large and small ruminants for different physiological stages. Concept of complete feed. Limiting nutrients and strategic feeding of high yielding ruminants. Concept of by-pass nutrients and their impact on production, reproduction and immune status. Importance of CLA, omega fatty acids, Scope for value addition in milk, Different systems of feeding buffalo o for beef production. Feeding during natural calamities, feeding in various agro-climatic zones of India.

Practical
Design and planning of feeding experiments. Identification of feed and fodder on the basis of its composition. Artificial rumen technique, Methods for evaluation of feedstuffs-in vitro gas, in sacco digestion kinetics. Determination of nutritive value of feeds and fodders by metabolism trial in dairy cattle, determination of nutritive value of pastures by the use of range techniques, study of rumen metabolic profile. Preparation of Bypass Nutrients Identification of rumen microbes and rumen studies.

Suggested Readings
Objective
To acquaint with inherent nutritional quality of feeds and forages and forages grown in different agro climatic regions of country. Forage preservation techniques and nutritional evaluation.

Theory

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

UNIT VI
by products of horticultural sources. Protein concentrates – oilseed cakes and meals, oilseed residues of minor importance, leguminous seeds, animal protein concentrates, milk products, single-cell protein, synthetic amino acids, non-protein nitrogen compounds as protein sources. Oil and legumes seeds and their by products, their feeding values and limitations.

**Practicals**

Fibre fractions as per Van Soest et al (1991) Carbohydrate fractions and Nitrogen fractions (CNCP system of analysis). Laboratory evaluation of preserved and processed feed and forages. Physical properties of feeds and feedstuffs, identification of insect-pests and fungi in stored products, techniques for detection of hidden infestation in grains, quality control and inspection of stored feed materials moisture equilibrium determination and estimation of chemical changes including alcoholic acidity, rancidity and uric acid in feeds during storage.

Weende proximate analysis, Van Soest fibre fractionation. Enzymatic evaluation, Pro-rata deduction (Feed laws) urea. Estimation of starch.

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**AN 614**

**NON CONVENTIONAL FEEDSTUFFS AND TOXIC CONSTITUENTS / ANTIMETABOLITES IN ANIMAL FEEDSTUFFS**

(2+1)

**Objective**

To understand the importance of alternate feeds and their use in augmenting profit in livestock farm. Different toxins present in feed stuffs, their properties and detoxification techniques.

**Theory**

**UNIT I**

Present and future feed requirements and current availability for livestock and poultry. Use of non-traditional feeds - By-products of agricultural, industrial, food processing units and forest by-products. Evaluation by chemical and biological methods. Formulation of economical rations. Level of inclusion of various non conventional feeds in livestock ration.

**UNIT II**

Classification of toxic principles in animal feedstuffs. Chemico-physical properties of various toxins. Effect of toxins on biological system and nutrients utilization in different species of livestock. Detoxification of toxin principles by various physical,chemical and biological techniques. Insecticide and pesticide residue detection.

**Practical**

Estimation of various protease inhibitors; tannins; and mycotoxins in various feeds and feedstuffs. Nitrates, HCN, oxalates, insecticide and pesticide residues, saponins, Gossypol, mimosine, heavy metals.

Suggested Readings
AN 615

FEED TECHNOLOGY

(1+1)

Objective
Introduction to the subject, formula feed manufacturing and different operations involved.
Layout, designing, operation and management of feed mill.

Theory

UNIT I
Importance of feed technology in relation to animal productivity and constraints in India.
Procurement, sampling, quality control, storage of feeds and inventory control.
Familiarisation of various feed mill equipments, layout and operations. Problems of feed manufacturing units and control measures. Safety aspects.

UNIT II
Introduction to least cost formula feed manufacturing including principals of material handling, grinding, mixing, pelleting block (frequents) and other major processing operations. Testing of efficiency of equipments, crumbling, flaking, popping, extrusion. BIS specifications of feeds and good manufacturing practices.

UNIT III
Automated feed mill. Personal management in feed plants, laws and regulation of feed manufacturing industry. Codex alimentarius, HACCP.
Organizational charts for small, medium and large feed plants, labour standard planning and production programme, handling of plant equipment. Merits and demerits of automated feed plant. Hazards in feed plants. Feed packaging. Safety and Health loss control management. Processing of crop residues and fodders for their preservation and enhanced nutrient utilization.

Practical
Identification of feed ingredients and their specifications, as well as compound feed for different categories of livestock and poultry. Prorata deductions on the bases of feed quality. Feed microscopy, Formulating premixes. Introduction to Pulverisers, pelletisers, complete feed blocks equipments, visit to feed plant for plant layout and design of different capacity of feed mills, problems related to feasibility, records keeping in different sections of feed mill. Experimental learning at the feed plant for preparing feed, urea molasses mineral blocks, mineral mixture.

Suggested Readings
Gohl BO. 1985. Teopical Feeds . FAO
AN 621 ANIMAL NUTRITION - MINERALS, VITAMINS AND FEED ADDITIVES (3+1)

Objective

Theory

UNIT I
Definition, history, classification, chemistry, functions, deficiencies and excesses, requirements and sources of water soluble and fat-soluble vitamins. Vitamin content of different feeds.

UNIT II

UNIT III

Practical
Suggested Readings


AN 622 NON-RUMINANT NUTRITION 1+1

Objective
Requirement of nutrients and feeding of various non-ruminants species for efficient quality production.

Theory

UNIT I
Nutrients, their metabolism and requirements for poultry and swine during different stages of growth and production. Limiting iminoacids-lysine and methionine.

UNIT II
Feeding systems and feed additives, feed formulations for different purposes including least cost rations.

UNIT III

UNIT IV
Nutritional factors affecting quality of the products. Hind gut fermentation and its importance, Nutrient requirements of rabbits and equines, Nutritional manipulation for producing value added egg, meat / pork

Practical

Design and planning for poultry and swine feeding experiments, formulation and compounding of general and least cost rations, determination of nutritive value of poultry and swine feeds by balance experiments, evaluation of protein quality, Visit to poultry and piggery units, feed and fodder stores, Use of software in least cost feed formulations. Basic principles governing the least cost formulation software's.

Suggested Readings
AN 623. NUTRITION OF COMPANION, LABORATORY, WILD AND ZOO ANIMALS

Objective
Preparation, storage and evaluation of feeds and feeding standards of companion/laboratory/wild and zoo animals.

Theory

UNIT I
Feed Habits, food patterns, digestive structure and functions companion laboratory, wild and zoo animals, Neutral dietary habits. Nutritional requirements of various species of animals.

UNIT II
Feeding standards and feeds habits of companion/laboratory animals, Importance of colostrums and feeding of neonates and growing animals. Feeding and care of nursing mothers. Feeding of sick and old animals. Post Surgical nutrition.

UNIT III

UNIT IV
Composition, presentation, sterilization, palatability, assessment and storage of companion/laboratory animals diets, companion food tables and their nutritional assessment. Mistakes and misleading information on companion food labels and labelling.

UNIT V
Nutraceuticles in companion/laboratory foods and animals foods. Nutritional deficiency diseases. Geriatric nutrition- corrective measures.

Practical
Formulation and preparation of hygienic, balanced diets and feeding for companion/laboratory animals. Characteristics of ration formulation and feeding schedules wild and zoo animals. Feeding schedules for sick and orphan wild/zoo animals. Artificial and emerging feeding. General feeding habits and different feed constituents of wild and captive animals. Research methodology of companion/laboratory animals. Processing and storage of companion/laboratory diets. Visit to Zoological parks and wildlife sanctuary.
AN 624 RESEARCH TECHNIQUES IN ANIMAL NUTRITION (1+3)

Objective
Planning and designing of experiments, use of various techniques in estimating chemical and bio-chemical constituents in fodders, blood milk, rumen liquor, meat, wool etc.

Theory

UNIT I

UNIT II
Criterion for the selection of techniques, application of tracer technique for the in vivo measurement of methane emission, VFA production rate, Principles and procedures for estimating the nutrient digestibility by the application of markers.

Practical
Preparation of buffers and measurement of pH, pKa, mineral estimation by AAS, ions estimation in feeds and biological fluids, Determination of gross energy in feeds, faeces and urine using Bomb calorimeter, Interpretation and presentation of results, VFA fractionation using GLC, Amino acid determination using HPLC, measurement of aflatoxins and urea in feeds.

Suggested Readings
AN-625 Principle and Practices in Animal Nutrition (3+1)

PART 1 : INTRODUCTION TO ANIMAL NUTRITION

1. Farm Animal and their Feed
2. Animal Nutrition: Its Role in Modern Agriculture and Society
3. Common Methods of Analysis for Nutrients and Feedstuffs
4. The Gastrointestinal Tract and Nutrition
5. Measurement of Feed and Nutrient Utilization

PART 2 : NUTRIENT METABOLISM

1. Carbohydrates and their sources
2. Lipids and their sources
3. Protein and their sources
4. Energy Metabolism
5. Mineral Elements
6. Mineral Toxicities and Organic Toxins in the Food Chain
7. Vitamins
8. Regulation of Nutrient Partitioning
9. Water

PART 3 : APPLIED ANIMAL NUTRITION AND FEEDING

1. Factors Affecting Feed Consumption
2. Feeding standards and Productivity
3. Feed Stuffs
4. Feed Preparation and Processing
5. Diet Formulation
6. Cattle and Buffalo Feeding
7. Sheep and Goats Feeding
8. Swine and Poultry Feeding

PART 4 : PRACTICALS

1. Identification of Common Feeds
2. Feeding Analysis, Detergent system
3. In-vitro Techniques for DM Digestibility
4. Ration Computations
5. Conducting Digestibility trial

Suggested Reading:

2. Animal Nutrition Science by Gordon M.C.L. Dryden
LIST OF COURSES TO BE OFFERED TO M.V.SC STUDENTS (ANIMAL NUTRITION)

SEMMESTER 1

MAJOR DISCIPLINE (Animal Nutrition)

AN-611(3+0) Energy and Protein
AN 612(2+1) Non conventional Feed stuffs and toxic consitutents/ antimetabolites in animal feedstuffs
AN 613(1+1) Feed Technology
AN 614 (2+2) Feeds and Forages for livestock
AN 615(2+1) Ruminant Nutrition

SUPPORTING COURSE

AB 601(3+1) Basic Biochemistry
Total credits : 19
Total credits : Major : 15 Supporting (Animal Biochemistry): 4
Total : 19

SEMMESTER 2

MAJOR COURSES

AN 621(3+1) Animal Nutrition-Minerals,vitamins and Feed additives
AN 622 (1+1) Non- Ruminant Nutrition
AN 623 (2+1) Nutrition of companion/laboratory, wild and zoo animals
AN 624 (1+3) Research Techniques in Animal Nutrition
ANN 629 (1+0) Masters Seminar

MINOR DISCIPLE (Animal Physiology)

AP 608 (2+1) Chemical Bioregulation in Physiological Processes AP 609 (2+1) Enviromental Physiology

SUPPORTING COURSES

ES 629 (3+1) Design of experiment

Total credits (Semester 11): Major 13
Minor 6
Supporting 4
Seminar 1
Total: 24

Overall credits during sem 1 and 11 Major : 15+13=28 Required: Major: 24
Minor :6 Minor : 6
Supporting: 8 Supporting: 3
Seminar :1 Seminar: 1
Thesis:20 Thesis: 20
Total : 63 Total : 60

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# List of Courses to Be Offered to Ph.D Students

## (Animal Nutrition)

### Semester 1

#### Major Discipline

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<thead>
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<td>AN 711</td>
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<td>Nutrition and rumen fermentation</td>
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<td>AN 713</td>
<td>Advances in micronutrients</td>
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<td>AN 714</td>
<td>Advanced techniques in nutrition and research</td>
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#### Minor Discipline

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<tr>
<td>AP 706</td>
<td>Advances in Biosynthesis and secretion of milk</td>
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#### Supporting Course

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<th>Course Code</th>
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<tbody>
<tr>
<td>BT 602</td>
<td>Fundamentals of cell and molecular biology.</td>
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Total Credits (Semester 1): Major: 8  
Minor: 3  
Supporting: 3  
Seminar 1  
Total: 15

### Semester 11

#### Major Courses

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<th>Course Code</th>
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<td>AN 725</td>
<td>New feed resources and toxicants in animal feeding AN 729</td>
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#### Minor Courses

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<tr>
<td>AP 705</td>
<td>Advances in Reproductive Physiology</td>
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#### Supporting Course

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<tbody>
<tr>
<td>CS 621</td>
<td>Computer software package for statistical analysis</td>
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Total Credits (Semester 2): Major: 9  
Minor: 3  
Supporting: 3  
Seminar 1  
Total: 16

Overall credits during Sem 1 and 11

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<th>Category</th>
<th>Credits</th>
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<tr>
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<tr>
<td>Thesis</td>
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<td>Total</td>
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**Required Major:** 15  
**Minor:** 6  
**Supporting:** 3  
**Seminar:** 2  
**Thesis:** 45  
**Total:** 75
AN 711 MODERN CONCEPTS OF FEEDING MONOGASTRIC ANIMALS (2+0)

Objective
To impart knowledge on modern concepts in nutrient requirement and feeding of monogastric livestock.

Theory

Unit I

UNIT II
Developments in digestive physiology of swine –equines—Measurement of protein and energy requirements—Influence of processing of feed and fodders in monogastric animal nutrition.

UNIT III
Modern concepts of amino acid nutrition at various physiological status—Role of vitamins and minerals in health and disease. Advances in new generation feeds and feed additives.

Suggested Readings
Selected article from Journals

AN 712 NUTRITION AND RUMEN FERMENTATION (2+0)

Objective
To impart knowledge on nutrient requirements for neonatal and postnatal development of livestock, recent concepts of rumen fermentation and its manipulation.

Theory

UNIT I
Nutrient requirements for fertility and gestation, prenatal growth and foetal nutrition. Post-natal feeding, growth and developments - Body composition at prenatal and postnatal stages, abnormalities due to malnutrition.
UNIT II

AN 713 ADVANCES IN MICRONUTRIENTS (1+0)

Objective
Recent concepts of mineral and vitamin nutrition and their role in immunity, reproduction and other functions in animals.

Theory

UNIT I

UNIT II
Developments in vitamin and mineral requirements for growth, reproduction and lactation. Synthesis of vitamins by microbials in rumen and digestive tract. Identification and correction of deficiencies and toxicities of minerals in farm animals. Deficiency of minerals in different agro-climatic zones and area-specific mineral mixture, Micronutrients and immunity.

UNIT III

Suggested Readings


AN 714 ADVANCED TECHNIQUES IN NUTRITION AND RESEARCH (1+2)

Objective
To impart knowledge on use of advanced analytical techniques in nutrition research

Theory

Unit I
Developments in analysis of nutrients in feeds (NCP) methods. Estimation of toxins and mycotoxins – Application of atomic absorption spectrophotometer, HPLC - Enzymatic methods of feed analysis – Isotopes in nutrition research terms, types of decay, units, proportional counting, Gamma counting and beta counting, Handling of isotopes, precaution and safety – Analytical aspect of feeds and fodders using N.I.R.

Unit II
Faecal inoculums as alternative to rumen liquor in in vitro studies – Degradability of feeds by various techniques – rates of VFA and microbial production.

Practical
Estimation of major, minor and toxic minerals by atomic absorption spectrophotometer, Estimation of mycotoxin by HPLC, Estimation of oxalate, nitrates, tannin and mimosine, VFA fractionation by GC. Methane estimation using SF₆ Technique, amino acid analysis using HPLC, Microbial protein synthesis using purine derivatives, milk fat and FA estimation including CLA, Estimation of Pesticides.

AN 721 MODERN CONCEPTS OF FEEDING RUMINANTS AND FORAGE UTILIZATION (3+0)

Objective
To impart knowledge of modern concepts in nutrient requirement and feeding and enhanced utilization in ruminant and recent development in analysis of forages.

Theory

UNIT I
Dairy cows in intensive systems- environmental concerns. Recent developments in ruminant digestive physiology - Energy protein requirement and measurement - Requirements of other nutrients. Synchronization of energy and protein in rumen for maximum utilization of nutrients for enhancement in productivity. Importance of energy and protein quantity and quality Feed input and milk output relationship. Net energy model tropics. Details of CNCP system for evaluation of feed stuffs modelling of digestion and metabolism and nutrient requirements. Ghrelin and feed intake, Genetic potential redefined, in MOLLY Equation for lactating ruminants.

UNIT II

UNIT III


UNIT IV

Seminars on current topics of special interest. Suggested Readings

Selected articles from journals

AN 722 ADVANCES IN FEED TECHNOLOGY (1+0)

Objective

To impart knowledge on modern feed processing methods and automated feed plant layout

Theory

UNIT I

Current status of feed industry , Feed and fodder processing - Particle size reduction - bulk density - processing of grains and oil seeds - processing of roughages - feed plant layout and design - feed plant management - storage of feeds. Computer based control system. Sanitation and pest management.

UNIT II

Non conventional feed resources - Formulation of concentrates, premixes and rations - improvement of nutritive value of poor quality roughages – liquid feed supplements. Solid state fermentation (SSF) technology. Codex alimentarius, HACCP, Quarantine measures.

AN 723 CLINICAL NUTRITION (1+0)

Objective
Impact of nutrition on health, immunity, digestive/metabolic disorders, reproductive performance, bacterial and parasitic infestations, organic toxins and stress nutrition, feeding management of sick animals

**Theory**

**UNIT I**

Nutritional factors responsible for disorders. Metabolic disorders and production diseases in farm animals. Prevention of metabolic disorders – recommended dietary regimen.

**UNIT II**


**UNIT III**

Stress nutrition and post surgical nutrition. Nutritional manipulation and feeding of sick animals. Pesticides residues in feed and fodder and their impact on animal health, reproduction and production.

**Suggested Reading**

Selected articles from journals.

**AN 724 NUTRIENT AND DRUG INTERACTION 2+0**

**UNIT I**

Effect of drugs on digestion and absorption of nutrients- Drugs and intestinal microbial interaction- Effect of drug and antibiotics as feed additives Physiological effects – Use and abuse.

**UNIT II**


Suggested Readings

Selected articles from journals.

**AN 725 NEW FEED RESOURCE AND TOXICANTS IN ANIMAL FEEDING (2+0)**

**Objective**

To impart knowledge on newer feed resources and their value in animal feeding and various toxic substances prevalent in feed and fodders.

**Theory**

**UNIT I**
Demand and availability of feed – formulation of database in computer- strategy in food animal production- agricultural by-products- Agro industrial by-products, Farm waste, crop residues, organic wastes of animals origin. Slaughter house waste, industrial waste and their feeding value in animals.

UNIT II
Processing to enhance feed utilization and availability Possible health hazards due to waste utilization chemical and nutritional changes in waste product due to processing. Quality standard and their acceptance.

UNIT III
Naturally occurring toxicants-Toxicants of plants and non-microbial origin. Naturally occurring alkaloids (Phyrolizidine alkaloids, Nicotiana alkaloids, Piperidine alkaloid, Quinolizidine alkaloid, Indole, Solanum Glycoalkaloid, Swainonine, Tall fescue toxis), Glycosides (Glucosinoals, Cyanogenic Glycosides, Cardiac glycosides, Saponine, Vicine, Convicine, Calcinogenic glycosides, Carcinogenic Braken Glycosides, Carboxyata glycoside), Proteins & Amino Acids ( Proteinase inhibitors, lectine, Thiaminase, legume bload, Heterocyclic (mimosine, etc.), Selenocompounds, Cathyrogens, Hypoglycin), Phenolics (Gossypol, phytoestrogen, Antifertility agents of plant origin, Sty Pandol, Sorghum polyphenols, Phenolic compounds in forages and fibrous feeds fuffs, polyphenolics and the Nutritional Ecology of herbinores) mycotoxins and other toxicity – Acquired toxicants, pesticides, weedicides and heavy metals.

UNIT IV
Effect of toxins on rumen fermentation and nutrient utilization. Methods of detoxification.

Suggested Readings
Selected articles from journals